Using Open and Interoperable Ways to Publish and Access LANCE AIRS Near-Real Time Data

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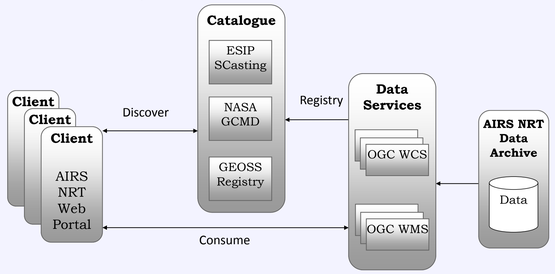
Introduction

The Atmospheric Infrared Sounder (AIRS) Near-Real Time (NRT) data from the Land Atmosphere Near real-time Capability for EOS (LANCE) element at the Goddard Earth Sciences Data and Information Services Center (GES DISC) provides information on the global and regional atmospheric state, with very low temporal latency, to support climate research and improve weather forecasting. An open and interoperable platform is useful to facilitate access to, and integration of, LANCE AIRS NRT data.

As Web services technology has matured in recent years, a new scalable Service-Oriented Architecture (SOA) is emerging as the basic platform for distributed computing and large networks of interoperable applications. Following the provide-register-discover-consume SOA paradigm, this presentation discusses how to use open-source geospatial software components to build Web services for publishing and accessing AIRS NRT data, explore the metadata relevant to registering and discovering data and services in the catalogue systems, and implement a Web portal to facilitate users' consumption of the data and services.



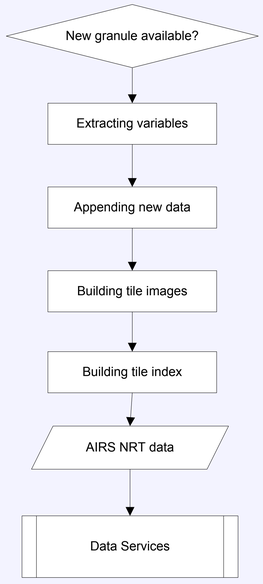
An open and interoperable way of access and integration of AIRS NRT data

AIRS NRT Data

AIRS NRT variables

Variable Name	Description	Data Source	Spatial Resolution	Temporal Range
CO	Total Column Carbon Monoxide (CO), in volume mixing ratio units of parts per billion, (ppb). The map is refreshed every 45 minutes, and about 2 hours behind real-time.	Level 2 AIRX2RET_NRT	30 km	Recent 9 days
RGB	False-color image using 3 visible channels taken from the variable "radiances": band3=0.8, band2=0.6, and band1=0.4 microns (μm). The map is refreshed every 45 minutes, and about 2 hours behind real-time.	Level 1B AIRVBRAD_NRT	2,7 km	Recent 9 days
BT_diff_SO2	Brightness temperature difference BT(1361.44 cm-1)- BT(1433.06 cm-1), in Kelvins (K), which can indicate SO_2 release from volcanoes. Differences under -6 are likely volcanic SO_2. The map is refreshed every 45 minutes, and about 2 hours behind real-time.	Level 1 AIRIBQAP_NRT	10 km	Recent 9 days
Dust_Score	Dust score values larger than "360" are dust events with increasingly larger likelihood. Thus only values above "360" are shown. The map is refreshed every 45 minutes, and about 2 hours behind real-time.	Level1B AIRIBQAP_NRT	10 km	Recent 9 days
IR_Precip_Est	Regression-based estimate of daily precipitation, in units of millimeters per day (mm/day). The map is refreshed every 45 minutes, and is about 2 hours behind real-time.	Level 2 AIRX2SUP_NRT	45 km	Recent 9 days

AIRS NRT Data Services



AIRS NRT data generation

OGC Web Coverage Service (WCS) (***http://disc1.sci.gsfc.nasa.gov/daac-bin/wcs_airsnrt***)

OGC WCS provides common interfaces to access customized multi-dimensional and multi-temporal geospatial data as a "coverage" . It supports the following operations:

- ***GetCapabilities***: returns an XML document with the service metadata and brief description of the data collection.
- ***DescribeCoverage***: returns a full description of one or more coverages.
- ***GetCoverage:*** allows retrieval of coverages with customized domain and range subsets, formats and projections.

OGC Web Map Service (WMS) (***http://disc1.sci.gsfc.nasa.gov/daac-bin/wms_airsnrt***)

OGC WMS provides geospatial data as a "map", which is generally rendered dynamically from real geographical data in a spatially referenced pictorial image format such as PNG, GIF, or JPEG. It supports the following operations:

- ***GetCapabilities***: returns an XML document with the service-level metadata and specific information about the available maps.
- ***GetMap***: returns an image of a map based on the user's requests.
- ***GetLegendGraphic***: returns a legend image for the requested layer.

OPeNDAP

OPeNDAP allows several open-source netCDF-based tools, such as Integrated Data Viewer, Ferret server, and Panoply, to directly transfer the level 2 data over the network. To enable users to locate swath data files in the OPeNDAP server that lie within a certain geographic area, graphical "granule maps" are being added to show the outline of each file on a map of the Earth.

Service Registration and Discovery

NASA's Global Change Master Directory (GCMD) (*http://gcmd.nasa.gov*)

The GCMD is a prominent catalogue system that enables users to publish, discover, access, and use Earth science data and data-related services relevant to global change and Earth science research. It uses a Service Entry Resource Format (SERF) to record service directory entries related to the acquisition, processing, retrieval, viewing, analysis, interpretation, and archival of Earth science data services. The SERF focuses on scientific descriptions of the data related to the registered service, rather than on how to access the service programmatically.

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  <Service_Topic> Web Services </Service_Topic>
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</Service_Parameters>
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  <Science_Topic> Atmosphere </Science_Topic>
<Science_Term> Atmospheric Chemistry </Science_Term>
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</Science_Parameters>
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</Service_Provider>
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  <Long_Name>Earth Observing System, Aqua</Long_Name>
</Source_Name>
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    <Subtype>GET WEB MAP SERVICE (WMS)</Subtype>
  </URL_Content_Type>
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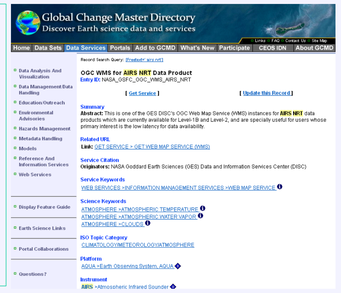
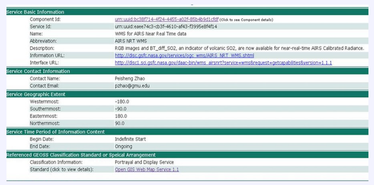
GCMD SERF description of AIRS NRT WMS



AIRS NRT WMS in GCMD

Global Earth Observation System of Systems (GEOSS)

The GEOSS is a global and flexible network of content providers that provides comprehensive, coordinated and sustained observations of the Earth system. Its registry system (**http://geossregistries.info**) defines a lightweight service taxonomy that includes service category, service standard, standard version, service binding, and service profile to capture domain knowledge and classify service instances. This taxonomy covers service running behaviors to represent service entities and relationships in formal structures. The GEOSS Clearinghouse collects all types of metadata from the GEOSS Registry to facilitate discovery and access of Earth observation data and services. End users can discover AIRS NRT data and data services in the GEOSS Clearinghouse according to the attributes of ISO 19139 metadata, such as title, keyword, identifier, type, bounding box, and temporal extent.



AIRS NRT WMS in GEOSS Registry

AIRS NRT WMS in GEOSS Clearinghouse

Federation of Earth Science Information Partners (ESIP)

ESIP Service Casting (*scast*) is a mechanism for a decentralized service catalogue not requiring a centralized system and a specified central repository. ESIP *scast* uses Atom syndication feeds, a simple HTTP-based protocol for creating and updating web resources with machine-readable metadata for service categorization, and a set of interface description links for automatic service invocation. ESIP Data Casting (*dcast*) is an RSS-based technology that enables provider to publish data through a Web-feed with relevant data metadata. ESIP *scast* and *dcast* allow users to subscribe to the feeds for identification, download, and access to the data and services.

```
<entry>
    <title>AIRS Near Real Time WMS</title>
    <id>uri:http://g0hep12u.ecs.nasa.gov/mapserv-bin/airsnrt_wms</id>
    <updated>2008-10-22T19:33:59.368863</updated>
   <summary>AIRS Near Real Time WMS views of BT_diff_SO2 (an indicator of
volcanogenic SO2) and RGB images</summary>
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    <scast:serviceProtocol>HTTP</scast:serviceProtocol>
    <category schema="scast" term="AIRS Near-real-time SO2" />
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href="http://disc1.ecs.nasa.gov/daac-bin/airsnrt_wms" />
    <link rel="scast:serviceDocumentation" type="text/html" xml:lang="en-us"
      title="Service documentation"
href="http://disc.gsfc.nasa.gov/services/wxs_ogc.shtml" />
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ESIP *scast* (Atom feed) for AIRS NRT WMS

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<item>
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product/airsL1B_vis_Rad.shtml</link>
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AD_NRT.005/2011/324/AIRS.2011.11.20.086.L1B.VIS_Rad.v5.0.14.0.R11324044407.hdf"
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</datacasting:productName>
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S_NRT/AIRVBRAD_NRT.005/2011/324/AIRS.2011.11.20.086.L1B.VIS_Rad.v5.0.14.0.R1132240
44407.hdf</guid>
 <pubDate>Sun, 20 Nov 2011 09:44:07 GMT</pubDate>
 <source url="http://discnrt1.ecs.nasa.gov/datacasting/">AIRVBRAD_NRT Feed</source>
</item>
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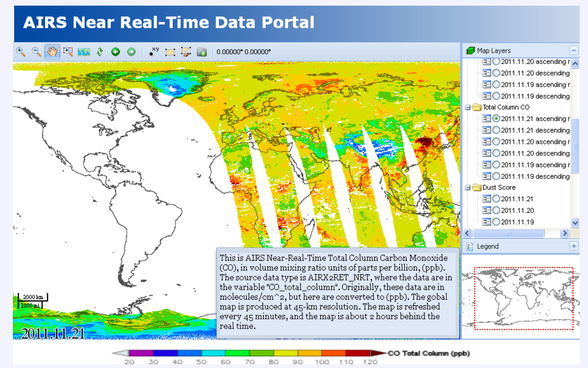
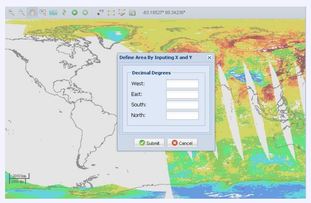
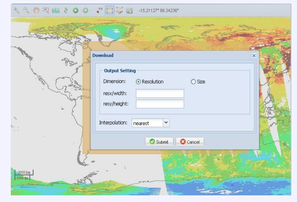
ESIP *dcast* (Atom feed) for AIRS AIRVBRAD data

Data Portal







AIRS Near Real-Time Data Portal (***http://disc.sci.gsfc.nasa.gov/nrt/data-holdings/airs-nrt-products/MapViewer***) is a rich Web-based geographic application designed for access to, and visualization of, AIRS NRT data through AIRS NRT WCS and WMS.